What we claimed are:

Sub A1

1. An optical amplifier for amplifying wavelength division multiplexed signal light which contains respective optical signals of a first wavelength band and a second wavelength band, comprising

optical amplifying means for amplifying said wavelength division multiplexed signal light using a rare earth element doped fiber to which excitation light is supplied,

wherein the excitation light used by said optical amplifying means has a wavelength capable of producing Raman amplification with respect to optical signals of said second wavelength band, and

by supplying a part of said excitation light used in said optical amplifying means to a Raman amplification producing medium which forms at least a part of an external transmission path arranged on a pre-stage side of said optical amplifying means, wavelength division multiplexed signal light which contains optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying means.

2. An optical amplifier according to claim 1,

wherein there is provided demultiplexing means for demultiplexing said wavelength division multiplexed signal light into respective optical signals of a first wavelength band and a second wavelength band, and multiplexing means for multiplexing respective optical signals of the first wavelength band and the second wavelength band which have been demultiplexed by said demultiplexing means,

said optical amplifying means has a first amplifying section for amplifying optical signals of the first wavelength band which have been demultiplexed by said demultiplexing means, and a second amplifying section for amplifying optical signals of the second wavelength band which have been demultiplexed by said demultiplexing means, and

by supplying via said demultiplexing means a part of said excitation light used in said first amplifying section to said Raman amplification producing medium, optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input via said demultiplexing means to said second optical amplifying section.

3. An optical amplifier according to claim 2, wherein when said first wavelength band is a 1550nm band and said second wavelength band is a 1580nm band, a

wavelength of the excitation light used in said first optical amplifying section contains a 1480nm band.

Sub A2

4. An optical amplifier according to claim 3, wherein said first optical amplifying section comprises an erbium doped fiber, at least one excitation light source for generating excitation light of a 1480nm band, and an optical coupler for supplying excitation light generated by said excitation light source to said erbium doped fiber from a rear side, and a part of said excitation light is passed through said erbium doped fiber and said demultiplexing means and supplied to said Raman amplification producing medium.

5. An optical amplifier according to claim 1, wherein there is provided demultiplexing means for demultiplexing said wavelength division multiplexed signal light into respective optical signals of a first wavelength band and a second wavelength band, and multiplexing means for multiplexing respective optical signals of the first wavelength band and the second wavelength band which have been demultiplexed by said demultiplexing means,

said optical amplifying means has a pre-stage amplifying section for collectively amplifying said wavelength division multiplexed signal light input to said demultiplexing means, and a second optical amplifying section for amplifying only optical signals of the second wavelength band which have been demultiplexed by said demultiplexing means, and

by supplying said excitation light used in a part of said pre-stage optical amplifying section to said Raman amplification producing medium, wavelength division multiplexed signal light which contains optical signals of said second wavelength band which have been Raman amplified by said Raman amplification producing medium are input to said pre-stage optical amplifying section.

6. An optical amplifier according to claim 5, wherein when said first wavelength band is a 1550nm band and said second wavelength band is a 1580nm band, a wavelength of the excitation light used in said pre-stage optical amplifying section contains a 1480nm band.

Sub A3

7. An optical amplifier according to claim 6, wherein said pre-stage optical amplifying section comprises; an erbium doped fiber, at least one excitation light source for generating excitation light of a 1480nm band, and an optical coupler for

~~supplying excitation~~ light generated by said excitation light source to said erbium doped fiber from a rear side, and a ~~part of said excitation~~ light is passed through said erbium doped fiber and supplied to said Raman amplification producing ~~medium.~~

8. An optical amplifier according to claim 1, wherein said Raman amplification producing medium is an optical fiber which is designed so that a non-linear effective cross section is small compared to a 1.3μm zero dispersion single mode fiber.

Sub A4

9. An optical amplifier according to claim 1, wherein said external transmission path is of a hybrid transmission path formed by connecting a positive dispersion fiber having a positive wavelength dispersion value and a positive dispersion slope with respect to a signal light wavelength band, and a negative dispersion fiber having a negative wavelength dispersion value and a negative dispersion slope with respect to the signal light wavelength band, and one end on the side of said negative dispersion fiber is arranged at an input side of said optical amplifying means and functions as said Raman amplification producing medium.

10. An optical amplifier according to claim 1, wherein there is provided optical power constant control means for monitoring an output power of said wavelength division multiplexed signal light, and controlling an excitation light driving condition of said optical amplifying means so that said output power becomes constant.

11 An optical amplifier according to claim 1, wherein there is provided gain constant control means for monitoring a gain in said optical amplifying means, and controlling an excitation light driving condition of said optical amplifying means so that said gain becomes constant.

12 An optical amplifier according to claim 1, wherein there is provided supervisory control means for processing a supervisory control signal transmitted together with said wavelength division multiplexed signal light.

~~13.~~ An optical amplifier for amplifying wavelength division multiplexed signal light which contains respective ~~optical signals~~ of a first A wavelength band and a second wavelength band comprising:

pre-stage optical amplifying means for collectively amplifying respective optical signals of said first wavelength band and said second wavelength band for said wavelength division multiplexed signal light,

demultiplexing means for demultiplexing the wavelength division multiplexed signal light which has been amplified by said pre-stage amplifying means into optical signals of a first wavelength band and optical signals of a second wavelength band,

post-stage optical amplifying means for amplifying only optical signals of the second wavelength band which have been demultiplexed by said demultiplexing means, and

multiplexing means for multiplexing optical signals of the first wavelength band which have been demultiplexed by said demultiplexing means, and optical signals of the second wavelength band which have been amplified by said post-stage optical amplifying means.

14. An optical amplifier according to claim 13 comprising:

first power monitor means for monitoring the optical signal power of the first wavelength band which has been demultiplexed by said demultiplexing means;

second power monitor means for monitoring the optical signal power of the second wavelength band which has been amplified by said post-stage optical amplifying means; and

optical power deviation control means for controlling the operation of at least one of said pre-stage optical amplifying means and said post-stage optical amplifying means in response to the respective monitor results of the first and second power monitor means, so that the optical power deviation for the first and the second wavelength bands becomes constant.

15. An optical amplifier according to claim 13, wherein said first wavelength band is a 1550nm band, and said second wavelength band is a 1580nm band.

16. An optical amplifier according to claim 13, wherein there is provided optical power constant control means for monitoring the optical power of the wavelength division multiplexed signal light output from said multiplexing means, and controlling the operation of at least one of said pre-stage optical amplifying means and said post-stage optical amplifying means so that said output power becomes constant.

~~17. An optical amplifier according to claim 13, wherein there is provided gain constant control means for monitoring a gain in said pre-stage optical amplifying means and said post-stage optical amplifying means, and controlling the operation of at least one of said pre-stage optical amplifying means and said post-stage optical amplifying means so that said gain becomes constant.~~

Add A6

ADD B3